

Claims

1. An ultrasound contrast agent comprising an injectable oil-in-water emulsion wherein there are gas-containing nucleation sites associated with droplets of the dispersed oil phase.  
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2. A contrast agent as claimed in claim 1 wherein the nucleation sites are present within dispersed oil phase droplets.  
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3. A contrast agent as claimed in claim 2 wherein the nucleation sites comprise free gas microbubbles, surfactant- or lipid-stabilised gas microbubbles, polymer- or protein-encapsulated gas microbubbles, gas-containing porous solid microparticles, gas-containing rough-surfaced solid microparticles, gas-containing polymeric microparticles, or gas-containing fullerenes, clathrates or nanotubes.  
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4. A contrast agent as claimed in claim 1 wherein nucleation sites are present within membranes stabilising the dispersed oil phase droplets or in contact with the outside of such membranes.  
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5. A contrast agent as claimed in any of the preceding claims wherein the oil phase comprises one or more components selected from aliphatic ethers, polycyclic oils and alcohols, heterocyclic compounds, aliphatic hydrocarbons, cycloaliphatic hydrocarbons and halogenated hydrocarbons, said component(s) having a boiling point not exceeding 60°C.  
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6. A contrast agent as claimed in claim 5 wherein the oil phase comprises one or more perfluorocarbons.

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7. A contrast agent as claimed in claim 6 wherein said perfluorocarbon is selected from perfluorobutanes, perfluoropentanes, perfluorohexanes, perfluorocyclobutane, perfluorodimethylcyclobutanes, 5 perfluorocyclopentane, perfluoromethylcyclopentane, perfluorobutenes, perfluorobutadienes, perfluoropentenes, perfluorohexenes, perfluorocyclopentene, perfluorocyclopentadiene and perfluoro-t-butanol.

10 8. A contrast agent as claimed in any of the preceding claims wherein the oil phase contains a gaseous solute.

15 9. A contrast agent as claimed in claim 8 wherein the oil phase comprises air, oxygen or carbon dioxide dissolved in a liquid fluorocarbon.

20 10. A contrast agent as claimed in any of the preceding claims wherein the dispersed oil phase droplets are stabilised by a surfactant selected from fatty acids, carbohydrate and triglyceride esters of fatty acids, phospholipids, proteins, block copolymer surfactants, fluorine-containing surfactants and cationic surfactants.

25 11. A contrast agent as claimed in any of claims 1 to 9 wherein the dispersed oil phase droplets are stabilised by polymeric wall-forming encapsulating material or by incorporation into porous latex particles.

30 12. A contrast agent as claimed in any of the preceding claims wherein the oil phase has a boiling point not exceeding 42°C.

35 13. A combined preparation for simultaneous, separate or sequential use as a contrast agent in ultrasound imaging, said preparation comprising:

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- i) a contrast agent as claimed in any of the preceding claims, and
- ii) a vasodilator drug.

5 14. A combined preparation as claimed in claim 13 wherein said vasodilator drug is adenosine.

10 15. A drug delivery agent comprising a contrast agent as claimed in any of claims 1 to 12 together with a therapeutic drug.

15 16. A drug delivery agent as claimed in claim 15 wherein a hydrophobic drug is dissolved in the oil phase.

17. A drug delivery agent as claimed in claim 15 wherein the drug is present as nano- or micro-sized particles.

20 18. A method of generating enhanced images of a human or non-human animal subject which comprises the steps of injecting a contrast agent as claimed in any of claims 1 to 14 into the vascular system of said subject and generating an ultrasound image of at least a part of 25 said subject.

19. A method as claimed in claim 18 wherein microbubble growth from the contrast agent is activated within the subject by application of external activation.

30 20. A method as claimed in claim 19 wherein said external activation comprises ultrasound irradiation.

35 21. Use of a contrast agent as claimed in any of claims 1 to 12 in ultrasound therapy.

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22. Use as claimed in claim 21 wherein said therapy involves cell killing or blocking of blood flow to a site of interest.